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F-16 AIRCREW TRAINING DEVELOPMENT PROJECT

Contract No. F02604-79-C8875 ✓

PROGRAM/SYSTEM CONSTRAINTS
ANALYSIS REPORT

DEVELOPMENT REPORT No. 15 ✓
MARCH 1981

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Prepared in fulfillment of CDRL no. B021

by

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PREFACE

This report was created for the F-16 Aircrew Training Development Project contract no. F02604-79-C8875 for the Tactical Air Command to comply with the requirements of CDRL no. B021. The project entailed the design and development of an instructional system for the F-16 RTU and instructor pilots. During the course of the project, a series of development reports was issued describing processes and products. A list of those reports follows this page. The user is referred to Report No. 34, A Users Guide to the F-16 Training Development Reports, for an overview and explanation of the series, and Report No. 35, F-16 Final Report, for an overview of the Instructional System Development Project.

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F-16 AIRCREW TRAINING
DEVELOPMENT PROJECT REPORTS

Copies of these reports may be obtained by writing the Defense Technical Information Center, Cameron Station, Alexandria, Virginia 22314. All reports were reviewed and updated in March 81.

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EXECUTIVE SUMMARY

The development and implementation of a training system is carried out in the presence of certain constraints which impact the effectiveness or efficiency of the training. These constraints include operating policies and regulations, existing facilities and equipment, characteristics of the student population, and personnel availability. The task of the contractor team was to investigate and identify constraints likely to affect the F-16 instructional system design and describe system design restrictions imposed by them. Such information will be used by the contractor team in designing the F-16 instructional system to accommodate those constraints identified, and by USAF/TAC agencies in an effort to mitigate the effects of these constraints whenever/wherever possible. Such efforts should result in increased communication between the contractor team and USAF/TAC agencies in coordinating possible changes.

The constraints operating in the F-16 environment were categorized as due to:

1. Limited data.
2. Existing regulations.
3. Resource limitations.
4. Existing programs.
5. Given inputs.
6. Environmental factors.
7. Expected system changes.

For each constraint, specifics have been identified and the data source, probable impact on system, possible actions, and implications are discussed.

Some constraints identified such as weather, range availability, and air space are "hard" and must be accommodated by the training system. Other constraints such as USAF/TAC regulations and policies, trainer delivery schedules, or student flow could be changed to be more compatible with the training program. Finally, some constraints such as facilities and media available are within the scope of the training system and can be modified. As a result of this study analysis, the F-16 ISD effort has been able to better plan the training program within existing system constraints.

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PROGRAM/SYSTEM CONSTRAINTS ANALYSIS REPORT

1.0 INTRODUCTION

The design of an instructional system is executed in the presence of certain constraints. These constraints limit the resources used during system operations and govern system operation levels and quality, and quantity of system output. Military training constraints include such factors as operating policies and regulations, existing programs, equipment and facilities availability, characteristics of the input student population, or requirements for the output of graduates. In the area of pilot training, additional constraining factors are considered such as weather variability, which can affect flyable training days, aircraft ready (availability) rate, and the imposed sortie generation rate.

As part of the F-16 Aircrew Training Development Project, the contractor team was tasked to investigate and identify constraints likely to impact the F-16 instructional system design and describe the system design restrictions imposed by them.

In response to this direction, a detailed constraints analysis was conducted.

2.0 METHOD

In the performance of the analysis, the following potential constraint factors were analyzed:

- a. Existing USAF/TAC regulations, directives, and manuals
- b. Existing USAF/TAC training or resource utilization programs
- c. Aircraft availability projections, including aircraft mix and sortie generation rates
- d. Student flow and instructor availability projections
- e. USAF manning projections

f. Environmental variables

g. Safety programs

h. Other factors such as media, facilities, and trainer and devices projected availability schedules

These factors led to the identification of constraints under the following broad categories:

- Data limitations
- System changes
- Resource limitations
- Existing programs
- Existing regulations
- Given system inputs
- Environmental factors

The gathering of data relating to these categories was initiated with the review of existing USAF and TAC manuals and regulations. At the onset of these reviews, it was assumed that one could differentiate between regulations and manuals as to their impact in specifying constraints. Subsequently, however, it was determined that each regulation or manual should be treated as a possible source of constraints.

A high-level, cursory review was conducted of the 50-60 series documents. From this review, 75 documents were selected for further review. From these documents, 31 regulations and manuals were reviewed in detail as having impact on the F-16 system design. These documents have been made a part of the F-16 Operational Training Development (OTD) team reference library. The results of their review are presented, where appropriate, in the tabular summary, Section 4.0 of this report.

In addition to this review, contacts were established with other AF agencies and airframe contractor information points to gather information relating to constraints. These points of contact included:

- a. ASD, Wright-Patterson AFB
- b. TAC/DOOT
- c. Air Training Command (ATC)
- d. Fighter Lead-in Training (FLIT)
- e. General Dynamics, Fort Worth

Concurrent with the documentation review and the contacts and discussions with other data sources, a daily review of the F-16 OTD team incoming message file was initiated, and will be continued throughout the program, to insure data currency for any

newly established or projected system changes which might indicate a constraint situation.

Originally, the TAC F-16 OTD team had planned to provide the contractor with the F-16 Programmed Flying Training (PFT) Plan at the Phase II review as one of the documents providing input to the constraints analysis. Understandably, with a newly emerging weapon system, the PFT was not available as planned. As a result, the information presented in this report which relates to PFT data factors must be viewed as representing the "best guess" data available to the project as this point in time.

It should also be noted that some of the documents reviewed, for example, TACR 8-1 (TAC Formal Flying and Related Publications System), were under revision at the time of the analysis. However, any changes needed in the results of this report as the result of document revisions will be handled with appropriate update procedures discussed in the following section.

3.0 DATA UPDATE

The constraints analysis must be an ongoing effort reflecting the latest F-16 system configuration data and related training system design requirements. As stated previously, portions of the results presented in this report are based on preliminary "best guess" data. This is not an unusual situation for an aircraft still in the preproduction phase. Historically, it has been shown that early data for new, emerging systems, must be viewed as being quite "fluid" in nature. The constraints imposed at this time may not necessarily be those imposed at the time the F-16 is introduced into the operational inventory. As soon as new or more firm data becomes available to the F-16 OTD team, the contents of this report will be updated accordingly.

4.0 RESULTS

This section presents a summary, in tabular format, of the program/system constraints analysis results. Each page of the summary presents a statement of the constraint, the data source for the constraint, a statement on the impact of the constraint on system design or operation, a statement of possible actions on the part of system designers in response to the constraint, and a section evaluating implications where appropriate. The constraints are presented under the following headings:

1. Limited data
2. Existing regulations
3. Resource limitations
4. Existing programs
5. Given inputs

6. Environmental factors
7. System changes

The order in which the constraints are presented is not significant since they are not rank ordered. The training system design is proceeding based on this latest data available while maintaining a design flexibility which will readily accommodate updated constraints data as additional information becomes available to the instructional design team.

4.1 Limited Data

This section reviews the constraints placed upon system design by the unavailability of data which must be used in the design.

PROGRAMMED FLYING TRAINING PLAN

CURRENCY DATE: 7/18/78

STATEMENT OF CONSTRAINT:

At the time this report was initially published, the PFT Plan had not yet been issued for the F-16. This plan contains information which is important to system design because it provides the F-16 student flow which the design must accommodate, and the sortie generation rates which must be met.

CONSTRAINT DATA SOURCE:

Headquarters TAC.

PROGRAM IMPACT:

Design effort: Lack of firm data on sortie generation rate, student throughput, aircraft (A/C) available (A Model - B Model, etc.)

ACTION TO BE TAKEN:

Proceed with design based on "best estimate" data. Maintain design flexibility to accommodate firm data when it is received.

IMPLICATIONS:

Late jelling plans are possible as well as over or under estimates of student loads, aircraft availability, and sortie generation rate requirements, which can be corrected by syllabi design flexibility. Long term effects may be mitigated by the availability of current data as new sites of the instructional system are activated.

4.2 Existing Regulations

This section reviews constraints which arise from regulations in existence prior to the instigation of the F-16 project.

TACTICAL AIR COMMAND MANUAL (TACM 51-50)

CURRENCY DATE: 7/18/78

STATEMENT OF CONSTRAINT:

TACM 51-50 establishes minimum AF standards for training and qualifying personnel performing duties in TAC assigned aircraft.

CONSTRAINT DATA SOURCE:

TACM 51-50: "Tactical Fighter/Reconnaissance Aircrew Training," 12 August/1 September 1977.

PROGRAM IMPACT:

Primary impact is in the areas of the task listing and the development of CROs that build toward, as near as possible, a mission ready (MR) graduate from F-16 training. Volume VIII of TACM 51-50 must be in agreement with the F-16 Training Program design CRO's.

ACTION TO BE TAKEN:

Pursue the design of the optimum system and insure that TACM 51-50 Chapter VIII content reflects the results of the design effort.

IMPLICATIONS:

There will be a requirement during the years of operations of the F-16 instructional system for continuing coordination of TACM 51-50 standards with F-16 standards.

AIR FORCE MANUAL (AFM 127-1)

CURRENCY DATE: 7/15/78

STATEMENT OF CONSTRAINT:

AFM 127-1 provides guidance for the prevention and investigation of aircraft accidents and incidents. These safety factors must be considered in all system design decisions.

CONSTRAINT DATA SOURCE:

AFM 127-1: "Safety, Aircraft Accident Prevention and Investigation," 14 July 1976.

PROGRAM IMPACT:

This regulation impacts system design in that it is of primary concern in all aspects of design for training.

ACTION TO BE TAKEN:

System design efforts must insure that safety takes precedence over all other factors.

IMPLICATIONS:

Future design changes must be compared to existing AFM 127-1 regulations, and revisions of the regulation must be examined for effects upon the F-16 instructional system throughout its life time.

TACTICAL AIR COMMAND REGULATION (TACR 50-31)

CURRENCY DATE: 7/15/78

STATEMENT OF CONSTRAINT:

TACR 50-31, establishes a program for completing, maintaining, and disposing of training records generated in TAC units conducting syllabus training. It also provides academic testing procedures and flying and simulator performance evaluation, course training standards and direction.

CONSTRAINT DATA SOURCE:

TACR 50-31: "Training Records and Performance Evaluation in Operations Flying Training Programs," 4 November 1975.

PROGRAM IMPACT:

This regulation has an impact on F-16 performance evaluation design for flying training and simulator training and the academic testing procedures developed. It also sets forth the procedures to be followed in handling sub-standard performance, course critiques and student training records.

ACTION TO BE TAKEN:

Proceed with the system design, including performance evaluation. The performance evaluation design for F-16 will be subjected to tryout during the 1979 interim training. As a result of the tryout, recommendations for changes to TACR 50-31 will be developed and submitted.

IMPLICATIONS:

Any future system design changes must be reviewed against TACR 50-31 requirements to insure compatibility with requirements of the latest issue of the document.

AIR FORCE REGULATION (AFR 60-1)

CURRENCY DATE: 7/15/78

STATEMENT OF CONSTRAINT:

AFR 60-1 establishes policy for the management of AF flying resources, and guidance applicable to the administration of flight management, aircrew training, and aircrew evaluation programs.

CONSTRAINT DATA SOURCE:

AFR 60-1: "Flight Management," 2 January 1975.
AFR 60-1: "Tactical Air Command Supplement 1," 16 September 1976.

PROGRAM IMPACT:

The F-16 syllabus, CRO's, and performance measurement system criteria must take into account the requirements of AFR 60-1.

ACTION TO BE TAKEN:

If changes are required/recommended to best meet the requirements of an optimum F-16 program, adequate back-up rationale will be developed for any recommended modification.

COMMENTS/RATIONALE:

Recommendations for improvement are encouraged. Major Commands (MAJCOMs) may supplement as necessary, based upon MAJCOM requirements.

IMPLICATIONS:

The requirements of AFR 60-1 need to be reviewed throughout the life cycle of the F-16 program as changes/supplements are issued. In addition, where F-16 training system design efforts indicate an area(s) of potential improvement to AFR 60-1, we can, and will, recommend changes and coordinate with TAC Headquarters on such changes for the TAC Supplement(s).

TACTICAL AIR COMMAND REGULATION (TACR 8-1)

CURRENCY DATE: 7/15/78

STATEMENT OF CONSTRAINT:

TACR 8-1 defines the formats to be followed in the development of training documents including the syllabus, Phase Manuals, briefing guides, student study guides, and student grade folders.

CONSTRAINT DATA SOURCE:

TACR 8-1: "TAC Formal Flying and Related Publications System." (Under revision at this time.)

PROGRAM IMPACT:

Documents developed for the F-16 Training Program should meet the requirements of 8-1 or a request for deviation from the formats set forth in this regulation needs to be submitted.

ACTION TO BE TAKEN:

Design F-16 documents to meet the requirements of the system design and make recommendations for changes to TACR 8-1 as appropriate.

IMPLICATIONS:

It can be anticipated that revisions to TACR 8-1 will occur as the needs of TAC change. The document must be continuously reviewed and where any future changes to F-16 training documentation are anticipated these changes must be checked against existing TACR 8-1 requirements.

TACTICAL AIR COMMAND MANUAL (TACM 51-5)

CURRENCY DATE: 7/15/78

STATEMENT OF CONSTRAINT:

TAC directive TACM 51-5 establishes TAC policy on aircrew training, program management criteria, administrative practices, and outlines all aircrew ground training required to maintain aircrews at a "high state of Combat Readiness".

CONSTRAINT DATA SOURCE:

TACM 51-5: "Training Management and Ground Training for Tactical Aircrews," 10 January 1978.

PROGRAM IMPACT:

Since the end of course mastery models for the Combat Crew Training (CCTs) and Continuation Training must correspond in some way to definitions of MR, F-16 syllabi must conform to TACM 51-5 requirements. At their present state of definition, however, TACM 51-5 requirements are not stated in terms compatible with ISD products.

ACTION TO BE TAKEN:

Proceed with the F-16 system design and develop CCT and Continuation Training mastery models providing the temporary interface with TACM 51-5 requirements and later coordinate in detail with the TAC Headquarters TACM 51-5 Office of Primary Responsibility (OPR) on our recommended changes to the manual.

IMPLICATIONS:

The requirements of TACM 51-5 need to be continuously considered throughout the F-16 training program life cycle. Further interaction between F-16 activities and TACM 51-5 OPR must be effected.

TACTICAL AIR COMMAND REGULATION (TACR 55-16)

CURRENCY DATE: 7/15/78

STATEMENT OF CONSTRAINT:

TACR 55-16 sets forth the standard operational and weapons employment procedures to be used by all tactical aircrews operating AF F-16 aircraft.

CONSTRAINT DATA SOURCE:

- a. F-16 OTD team telex reading file, telex 151345Z DEC 1977.
- b. TACR 55-16: Draft being developed; not yet available.
- c. TACR 55-16, 388th Tactical Fighter Wing (TFW) Supplement, Chapter VIII, presently in review cycle.

PROGRAM IMPACT:

This regulation impacts the content of the F-16 task listing, CRO's and associated operating procedures, particularly those which are peculiar to a particular training base and the local operating environment. The 388th TFW Supplement, Chapter VIII of TACR 55-16, for example, sets forth requirements and procedures to follow for Hill AFB, which are unique to Hill due to the altitude of the base and summer temperatures, winter flying conditions, crosswind conditions and so forth. In some instances this affects implementation of the syllabus and may lengthen the training course, depending on the base in question and its local environment and required procedures and regulations.

ACTION TO BE TAKEN:

Proceed with design of F-16 Syllabi. As training sites are activated, appropriate modification of syllabi may be required to meet local conditions.

COMMENTS:

The revised draft of this regulation is being prepared by TAC Headquarters and will be made available to the F-16 OTD team for review and coordination.

IMPLICATIONS:

This regulation will require review and consideration throughout the lifetime of the F-16 program to insure up to date best use of resources given local requirements.

Chapter VIII will vary depending upon the training base location and local operating procedures and environmental factors. These training base factors need to be considered in the syllabi for each training location.

TACTICAL AIR COMMAND MANUAL (TACM 25-5)

CURRENCY DATE: 7/15/78

STATEMENT OF CONSTRAINT:

TAC standard, TACM 25-5 presents procedures for computing and publishing aircrew, instructor, aircraft, and pipeline requirements. This standard applies to all CCT and related training units within TAC.

CONSTRAINT DATA SOURCE:

TACM 25-5: "Programmed Flying Training Factors (Management Engineering)," 1 October 1974.

PROGRAM IMPACT:

TACM 25-5 standardizes the methodology and provides guidance for making the determination as to the number of instructors required to conduct a given course.

ACTION TO BE TAKEN:

Design the optimum F-16 Training System determining support requirements based upon the results of Training Support Requirements Analysis (TSRA), to include determination of instructor requirements based upon the syllabus events.

COMMENTS:

Improved methods and innovations to the procedures contained in TACM 25-5 are encouraged. As these are developed and tested, they should be documented in the form of recommended changes to the manual.

IMPLICATIONS:

This manual provides specific guidance for accomplishing the requirements set forth in AFM 26-1, Manpower Policies and Procedures, and TACM 25-5, Management Engineering Policies and Procedures and will require continuous review and crosscheck with the F-16 Training Program design and conduct throughout the life cycle of the F-16 Weapon System.

4.3 Resource Limitations

This section discusses resource limitation constraints to be considered in the design and development of the F-16 Training Program.

TRAINERS MAINTENANCE LEARNING CURVE

CURRENCY DATE: 7/15/78

STATEMENT OF CONSTRAINT:

With both the Operational Flight Trainer (OFT) and the Weapons System Trainer (WST), as with the aircraft, there will be an initial maintenance learning curve which may make these devices unavailable for training at unpredictable periods of time.

CONSTRAINT DATA SOURCE:

Historical data from previous program development efforts.

PROGRAM IMPACT:

This constraint impacts system design, primarily, in the area of scheduling and the timely accomplishment of the training objectives assigned to the OFT or WST.

ACTION TO BE TAKEN:

Insure that system design/scheduling flexibility for OFT/WST unavailability is given proper consideration and provide for alternative training sessions when necessary to meet training objectives.

COMMENTS/RATIONALE:

This can be considered a "hard" constraint and one that is unpredictable at this time.

IMPLICATIONS:

As reliability and maintainability data becomes available for the OFT/WST, predications as to the unavailability of these devices can be developed and planned for in the training scheduling. Eventually this constraint should become minimal as maintenance experience is accumulated.

POST PROGRAM

CURRENCY DATE: 7/15/78

STATEMENT OF CONSTRAINT:

The Post Program, if implemented, with its associated surge factors will have a heavy impact on scheduling, including the A/C, Egress Procedures Trainer, Cockpit Familiarization Trainer (CFT), Instructor Pilots (IPs) and students to meet Post requirements.

CONSTRAINT DATA SOURCE:

F-16 OTD reading File: "TWX from 12th AF, 922139Z," December 1977. "Comments on Post Message from 4444th OTD teams."

PROGRAM IMPACT:

This Post Program, if required to be implemented, will impact system design in the areas of academic scheduling, syllabus sortie schedules, determination of sufficient IP manning, and the ability to implement planned instructional strategies. Several adverse effects are anticipated, including a decrease in the flow of useful communication between student and instructor. True decrement in effectiveness of sorties is anticipated to be fairly high. Since not all CCTs students are capable of deriving benefits from surge, scheduling procedures must accommodate and make the necessary selections for participation.

ACTION TO BE TAKEN:

Design additional training experiences into the syllabus to off set decrements in training effectiveness due to Post implementation.

IMPLICATIONS:

The F-16 training program design may have to be altered to accommodate academic scheduling and additional sorties to be compatible with flight surge requirements without decreasing training effectiveness. Most of these alterations are undesirable and effect expected decrements in system training effectiveness.

4.4 Given Inputs

This section reviews those constraints imposed by existing or "given" factors relating to F-16 Training Program design.

AIRBORNE VIDEO TAPE RECORDER (AVTR)

CURRENCY DATE: 7/15/78

STATEMENT OF CONSTRAINT:

The AVTR System will not be available on all aircraft and will not record panel indications. It will record data through the Head Up Display (HUD) and provide electrically reproduced pickup from subsystems to the radar electro-optical display (REO). The AVTR will be available starting with A/C #66 in April 1980.

CONSTRAINT DATA SOURCE:

General Dynamics Fort Worth Program personnel.

F-16 OTD team personnel.

PROGRAM IMPACT:

This given constraint has an impact on system design and the Performance Measurement System to be implemented for F-16 by limiting data collection during performance measurement.

ACTION TO BE TAKEN:

In design of the Performance Measurement System consider the AVTR but do not place heavy emphasis on the device at this time due to a lack of firm data. Include in instructor pilot training adequate preparation to alert IP's of an additional need for extra data collection should the AVTR not be available.

COMMENTS:

Eventually all A/C will be wired to accept the AVTR with an estimated 30 minutes required to transfer the video tape recorder (VTR) from one A/C to another.

IMPLICATIONS:

It is quite likely that sorties using VTR for performance measurement will be flown on schedule whether or not the VTR is workable. Therefore the syllabus and performance measurement design should accommodate accomplishment of sortie objectives without depending heavily on VTR capabilities.

EGRESS PROCEDURES TRAINER

CURRENCY DATE: 7/15/78

STATEMENT OF CONSTRAINT:

Preliminary data on the EPT indicates that there will be one device provisioned for each wing. The device will be used to train; ejection seat preflight procedures, ground egress procedures, and ejection procedures.

CONSTRAINT DATA SOURCE:

- a. Data from ASD/TAC Headquarters contained in the F-16 OTD team message file, and recommendations set forth from the F-16 OTD team to appropriate agencies.
- b. TACR 51-5 requirements.

PROGRAM IMPACT:

The design and capabilities of the EPT are a "given" factor for F-16 training design.

ACTION TO BE TAKEN:

Design the system deliberately to include appropriate EPT utilization. Anticipate more detailed information to be obtained from interim training concerning device effectiveness.

COMMENTS:

Delivery of one device to Hill AFB, is scheduled for January 1979.

IMPLICATIONS:

Experience with the EPT and its effective utilization to train ingress, egress, and ejection procedures will be gained during the 1979 interim training. The results of this experience will be applied/incorporated in the 1980 F-16 Syllabus.

FIRST SITE TRAINING FACILITIES

CURRENCY DATE: 7/15/78

STATEMENT ON CONSTRAINT:

Due to the lead time required for construction and procurement of equipment items, the requirements for the learning center along with associated classrooms, offices and media devices (carrels, 35 mm projectors, video playback units, etc.) have already been defined for the first F-16 training site (Hill AFB). This facility definition and associated requirements was based upon "best guess" data available during the last quarter of 1977.

CONSTRAINT DATA SOURCE:

F-16 OTD team and contractor report, as requested by USAF/TAC, submitted to the 388th TFW at Hill AFB, November 1977.

PROGRAM IMPACT:

Definition of these items constitutes a "given" for the first training site forced on the system by procurement time constraints. This constraint impacts syllabus design for the 1980 course at Hill AFB in that maximum, effective, use should be made of the facilities established.

ACTION TO BE TAKEN:

Design the instructional system and continue to determine associated facilities requirements for use at subsequent training sites even though first training site facilities have been defined.

IMPLICATIONS:

It appears that the first site facilities as defined will meet or exceed F-16 training requirements, and therefore do not present a constraint. System design efforts, in particular the TSRA, will examine facilities requirements for future training sites needs.

WEAPON SYSTEM TRAINER

CURRENCY DATE: 7/15/78

STATEMENT OF CONSTRAINT:

Presently available data on the WST indicates that each F-16 wing will be provisioned with one device.

The device will not be available for training use until may 1983.

CONSTRAINT DATA SOURCE:

Data from ASD/TAC Headquarters contained in the F-16 OTD team message file, and recommendations from the F-16 OTD team to appropriate agencies.

PROGRAM IMPACT:

The WST and its presently designed inventory of capabilities represents a "given" to the F-16 ISD design team in that the WST design and training utilization are predetermined. Syllabi design must, therefore, make maximum use of the WST existing capabilities within the time frame of its anticipated delivery.

ACTION TO BE TAKEN:

Design the system to include appropriate utilization of the WST and its capabilities based upon data available at this time and maintain design flexibility to meet any data changes that may occur during device development.

IMPLICATIONS:

Until the WST is available to the F-16 training program, those tasks which should or could best be trained in the WST will have to be accommodated by some other means.

OPERATIONAL FLIGHT TRAINER

CURRENCY DATE: 7/15/78

STATEMENT OF CONSTRAINT:

Preliminary data on the OFT indicates that there will be two devices provisioned for each F-16 wing.

The device will not be available by January 1980 for the first ISD course.

Although the ISD team has been included in some OFT design decisions, most of these decisions were made prior to the teams activation of the ISD team.

CONSTRAINT DATA SOURCE:

Data from ASD/TAC Headquarters contained in the F-16 OTD team message file, and recommendations set forth from the F-16 OTD team to appropriate agencies.

PROGRAM IMPACT:

The simulator with its present complement of training features and capabilities constitutes a "given". Design and utilization are mostly predetermined. Syllabi must be designed to take maximum benefit from existing capabilities.

ACTION TO BE TAKEN:

The system must be designed to include appropriate OFT utilization based upon data currently available and maintaining design flexibility to meet possible data changes.

COMMENTS:

Training planning should consider device delivery to Hill AFB, as presently projected, for May (+) 1980, and September 1980, for training site number two.

IMPLICATIONS:

F-16 syllabi must make maximum use of given OFT capabilities. Training that could best be conducted in the OFT will have to be accommodated by some other means prior to arrival of the OFT at Hill.

INTERACTIVE PART TASK TRAINER (IPTT)

CURRENCY DATE: 7/15/78

STATEMENT OF CONSTRAINT:

Present planning calls for one IPTT to be available for use in the F-16 Training Program at Hill AFB, prior to receipt of the first F-16 OFT in May 1980. This trainer is the Dynamic System Simulator (DSS) which provides capabilities for avionics integration and weapons delivery, e.g. stores control panel operation and realistic stick and throttle with appropriate switches/functions. This device will be available for F-16 training on a time-share basis only.

CONSTRAINT DATA SOURCE:

Data from the F-16 OTD team message file, including TAC/ALC correspondence.

PROGRAM IMPACT:

The capabilities of the DSS are somewhat limited for effective F-16 training. However, the system design must make the best possible use of the device on a time-share basis with scheduling designed to accommodate the needs of Air Logistics Command (ALC) and their use of the device.

ACTION TO BE TAKEN:

Design the system to include appropriate utilization of the DSS and its training capabilities, prior to receipt of the OFT in May 1980, if the device is going to be available (see comment below).

COMMENTS:

There is some question as to whether or not the DSS will be available on the Ready For Training (RFT) date due to contract difficulties.

IMPLICATIONS:

Utilization of this device following the arrival of the, F-16 OFT is unknown and should be considered in system design decisions.

STUDENT POPULATION AND FLOW

CURRENCY DATE: 7/15/78

STATEMENT OF CONSTRAINT:

F-16 student data is not yet firm, however, it can be assumed based on information available to date, that, incoming student profiles will vary, unscheduled students may need to be added to classes, foreign (EPG) students may present special language requirements.

CONSTRAINT DATA SOURCE:

F-16 OTD team message file, including Headquarters TAC level estimates.

PROGRAM IMPACT:

Impact on the F-16 training program design, in this instance, is in terms of the uncertain student flow (throughput) and scheduling of facilities and media devices and their level of use. Also, the required availability and training of instructors is difficult to assess in the absence of firm student load data.

ACTION TO BE TAKEN:

Design the system with a built-in flexibility to accommodate fluctuations in the flow of students and variations in student types, number and input qualifications.

COMMENTS:

The F-16 PFT Plan data for the 1980 training, when issued, should provide the data necessary for more effective planning.

IMPLICATIONS:

System design must proceed using "best guess" projections until firm data becomes available to the design team.

SORTIE GENERATION RATE

CURRENCY DATE: 7/15/78

STATEMENT OF CONSTRAINT:

The first draft of the F-16 PFT plan covering the 1980 time frame and required sortie generation rates had not yet been released from TAC Headquarters when this report was issued.

CONSTRAINT DATA SOURCE:

Preliminary "Hill AFB - Training Program" planning chart from TAC/DOOT, 13 March 1978.

PROGRAM IMPACT:

This constraint impacts system design and syllabi development in terms of scheduling flying training to meet required sortie generation rates. Low generation rates will slow student progress through the system. High sortie generation rates will present difficulties in meeting required academic training sessions.

ACTION TO BE TAKEN:

Proceed with system design and the specification of training sorties required to accomplish flying training objectives. Design the system to accommodate varying sortie generation rates as required.

COMMENTS:

Any data available at this time in relation to this constraint must be considered tentative planning data only while awaiting the finalized and approved F-16 PFT Plan.

IMPLICATIONS:

F-16 PFT data, even after initial official issue, will continue to be revised throughout the life cycle of the F-16 Weapon System. Efforts must continue to be made to gain the latest data available and reflect such information in system design on an on-going basis.

INSTRUCTOR MANNING

CURRENCY DATE: 7/15/78

STATEMENT OF CONSTRAINT:

Instructor personnel manning data is not firm at this time. Early Planning data from TAC/DOOT indicated an instructor build up resulting in the availability of thirty four IPs by January 1980. However, this figure may be higher at that time.

CONSTRAINT DATA SOURCE:

Preliminary "Hill AFB - Training Program" planning chart from TAC/DOOT, 13 March 1978.

PROGRAM IMPACT:

IP availability impacts system design in terms of scheduling and the accommodation of the student flow in January 1980.

ACTION TO BE TAKEN:

Proceed with system design using best projected estimates of instructors needed to handle the anticipated student load.

COMMENTS/RATIONALE:

Maintain design flexibility to accommodate any impact from PFT data when finalized.

IMPLICATIONS:

System design must be able to accommodate changes or fluxuations in student flow, IP availability, and aircraft availability.

COCKPIT FAMILIARIZATION TRAINER

CURRENCY DATE: 7/15/78

STATEMENT OF CONSTRAINT:

Preliminary data on the CFT indicates that there will be two devices per Tactical Fighter Training Wing (TFTW). In addition, the device will have sound/slide capability and will be used to train (based upon AF/TAC input); cockpit preflight procedures, cockpit systems operation (familiarization), and ground malfunction/emergency procedures.

CONSTRAINT DATA SOURCE:

Data from ASD/TAC Headquarters contained in the F-16 OTD team message file, and recommendations set forth from the F-16 OTD team to appropriate agencies.

PROGRAM IMPACT:

This is a given constraint for system design in that the training capabilities of the CFT are given and they direct CFT utilization for accomplishment of F-16 training objectives.

ACTION TO BE TAKEN:

Design the system to include appropriate CFT utilization based upon current device data, maintaining system design flexibility as to any changes in CFT capabilities or availability.

COMMENTS/RATIONALE:

Delivery of one device is scheduled no later than January, 1979 to Hill AFB. By January 1980 two devices will be available.

IMPLICATIONS:

In design of the system insure that the two CFT's will meet system requirements based on 1980 student flows. Data obtained from the 1979 Interim course and use of the CFT should be continuously reviewed for 1980 training course implications.

AVAILABLE AIRCRAFT AND MODEL MIX

CURRENCY DATE: 7/15/78

STATEMENT OF CONSTRAINT:

There will exist a set number of Aircraft per training wing with a determined mix of "A" Model and "B" Model. In January 1980, the first F-16 TFS will be equipped with ten "A" Models and twenty "B" Models for a total of thirty A/C. Including these thirty aircraft, the 388 TFW will have a projected forty-nine aircraft available for training in January 1980.

CONSTRAINT DATA SOURCE:

Preliminary, Tactical Air Command Headquarters (DOOT) "Hill AFB - Training Program", planning chart in rough form, 10 March 1978.

PROGRAM IMPACT:

This data impacts system design, primarily, syllabus sortie schedule development and aircraft model utilization to meet syllabus objectives because of early student flights which require "B" model aircraft.

ACTION TO BE TAKEN:

Design system to fit aircraft A/B model mix and training sortie objectives/requirements.

IMPLICATIONS:

Syllabus design must match dual (IP/student) and solo sortie requirements and objectives to A/B model aircraft availability. The projected A/B model aircraft mix appears adequate. Should the projected mix change, schedule trade-offs between academics and flight training will be required.

4.5 Environmental Factors

This section presents training system design constraints imposed by known environmental factors.

WEATHER FACTORS

CURRENCY DATE: 7/15/78

STATEMENT OF CONSTRAINT:

Conditions of weather variability will exist between the various F-16 training sites resulting in a variation of flying training days available.

CONSTRAINT DATA SOURCE:

"Air Weather Service Pamphlet 105-4," Volume I & II
"Climatic Briefs."

Experience from other programs.

PROGRAM IMPACT:

This is a constraint which impacts scheduling of flying training sorties in course design.

ACTION TO BE TAKEN:

System design must consider schedules in relation to predicted local, operating area, and range weather variables for all flying training. Flying training may need to be adjusted to accommodate local conditions.

IMPLICATIONS:

This is a constraint which must be given high priority in system design as syllabi implementation is considered for each local area.

RANGE AVAILABILITY AND CONFIGURATION

CURRENCY DATE: 7/15/78

STATEMENT OF CONSTRAINT:

It can be assumed that local availability and configuration of operating ranges (ACMR/I availability) will vary from one training site to another. This variability between training sites will also be true for available operational air space.

CONSTRAINT DATA SOURCE:

Discussions with knowledgeable TAC personnel and review of data from the F-16 OTD team message file.

PROGRAM IMPACT:

This is a constraint which impacts system scheduling and local operating area and range utilization.

ACTION TO BE TAKEN:

Design system flexibility with local syllabi tailored to fit local site range/air space availability taking full advantage of ACMR/I where available.

IMPLICATIONS:

The F-16 design team needs as soon as possible data on those training sites other than Hill AFB, so that proper consideration can be given to these constraint factors in course design flexibility.

4.6 System Changes

This section addresses those constraints associated with system changes that are inevitable with a new weapon system and its introduction into the TAC operational inventory.

SYSTEM CHANGES

CURRENCY DATE: 7/15/78

STATEMENT OF CONSTRAINT:

It can be expected that with the early production aircraft, and subsequent blocks of aircraft, entering the operational inventory, the system hardware, software, and procedures will undergo frequent changes as the system configuration changes over time.

CONSTRAINT DATA SOURCE:

a. Study data from analysis of Previous ISD Efforts, especially F-15 and A-10.

b. Historical data on the introduction of new weapon systems into the operational units.

PROGRAM IMPACT:

This constraint factor has a direct impact on instructional materials content and system structural design.

ACTION TO BE TAKEN:

Design the F-16 instructional materials for ease of adaptability, e.g., plug-in modules. Select media which are readily adaptable/modified to meet system changes as they occur.

IMPLICATIONS:

The design team must routinely have available to them for review all system change data in order to insure that the training system reflects the latest weapon system configuration and related procedures.

5.0 CONCLUSIONS AND SUMMARY

The conclusions of the constraints analysis are summarized in this section.

1. The benefits of this type of study analysis include the following improvements in team abilities:

The ability of ISD to effect better long-range coordination of the training environment is improved. Historically, ISD has not been in the design development loop early enough to influence or adjust the training environment. As a result, ISD has been severely constrained when just the opposite should be true.

This effort provided the contractor and the USAF OTD team the opportunity to study possible problems and early on recommend changes which could then be coordinated over a longer period of time. Examples of the effectiveness of this study include the recommendations concerning delivery of more "B" model aircraft than "A" model aircraft initially to accommodate initial training requirements and ISD Team inputs to OFT design decisions, particularly training attributes of the Instructor Console design.

The ability of the training contractor to better understand and communicate with the USAF/TAC training environment was improved.

The requirement for the contractor to study regulations and manuals, operational--"real world"--conditions, and related factors demonstrated areas of constraint particular to the USAF and tactical aircrew training.

The study analysis has resulted in a tentative identification of those factors within the USAF which are compatible and supportive of ISD and those which are not.

Recommendations concerning the revision or expansion of USAF/TAC regulations and manuals have, or will be, a natural result of this effort, as well as an increased communication between the contractor team and USAF/TAC agencies in coordinating possible changes.

The ability of the contractor to be more systematic and deliberate in design of the instructional system has been enhanced. Often, ISD is constrained by the scope of the issues it confronts and the tasks it is asked to carry out. The result is local solutions, solutions based on sketchy or inadequate information or outright assumptions which later prove to be wrong. Being exposed, as a result of the study analysis, to a broader range of issues has allowed the F-16 contractor/OTD team organization to include a wider range of more accurate information in instructional system planning and to design flexibility into areas of uncertainty. In this fashion, the

system design has been more deliberate and well informed than ISD efforts have been traditionally.

2. All factors identified thus far, and summarized in the previous sections, present or imply certain "hard" constraints for the design of the F-16 aircrew training system. These "hard" constraints vary in terms of "hardness"--some constraints, if need be, appear to be more easily resolved if it is determined that they hinder the best system design.

Some of the constraints identified, e.g., facilities and learning center media, apply only to the first F-16 training site.

Certain constraints such as weather, range availability and operational air space are training site (location) dependent and will require variations in the design approach taken and syllabi implementation for each site.

Effort should proceed with the design of the best system which provides maximum design flexibility, insuring the systems' ability to adapt to those constraints imposed which cannot be alleviated.

Whenever/wherever it is determined a constraint prohibits desired system design and should be modified or waived for the F-16 program, strong well founded, and well prepared back-up rationale must be presented to support recommendations for any relief action required.

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